

translation of the front page of the Utility Model  
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- (74) Agent: Patent Attorney, Takehiko SUZUE
- (56) References: JPA 53-94176  
JPA 54-137978

[Translation of utility model claim]

WHAT IS CLAIMED IS

[Claim 1]

A stage driving apparatus for driving a stage (2, 3, 4), on which a sample (P) is placed, in two dimensions, within a vacuum chamber (1), the apparatus comprising:

a moving member (13) disposed in the vacuum chamber (1) together with the stage (2, 3, 4) such that the moving member (13) moves in at least one direction (X) in the two dimensions;

a connecting plate (14) for connecting the moving member (13) and the stage (2, 3, 4) such that the stage (2, 3, 4) is driven in the one direction (X) by the moving member (13); and

a magnetic shield cover (19) having a slit (20) through which the connecting plate (14) traverses, the magnetic shield (19) covering only the moving member (13) over the moving range of the moving member (13).

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	21/68	K 8418-4M		
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(65)公開番号	実開昭62-114438	(74)代理人	弁理士 鈴江 武彦 (外2名)
(43)公開日	昭和62年(1987)7月21日		審査官 池淵 立
		(56)参考文献	特開 昭53-94176 (JP, A) 特開 昭54-137978 (JP, A)

(54)【考案の名称】 ステージ駆動装置

1

【実用新案登録請求の範囲】  
 【請求項1】 試料が載置されるステージを真空チャンバ内で2次元方向に駆動させるステージ駆動装置において、前記2次元方向のうちの少なくとも一方向に移動すべくステージに添って真空チャンバ内に配置された移動体と、この移動体によってステージを前記一方向へ駆動すべく移動体とステージとを連結する連結板と、この連結板を通すスリットを有し前記移動体のみをその移動範囲全周に亘って囲繞する磁気シールドカバーとを具備することを特徴とするステージ駆動装置。  
 【考案の詳細な説明】  
 【考案の技術分野】  
 本考案は、電子ビーム描画装置等におけるステージ駆動

2

装置に関する。  
 【考案の技術的背景及びその問題点】  
 電子ビーム描画装置のステージの駆動系としては多くの装置が考えられており、例えばステージ上に試料となる基板が載置される真空チャンバ内にボールネジを配置し、外部の駆動モータから真空回転シールを介して駆動力をボールネジに伝達してステージをX方向及びY方向の平面2次元方向に移動させる機構や、真空チャンバ外にもう一つの駆動テーブル機構を設け、伸縮するペローズを介して真空チャンバ内のステージと外部のテーブルを駆動棒で連結して駆動させる機構等がある。  
 ところが、このような従来装置にあっては、前者のような駆動機構の場合、ボールネジが通常非磁性でないため、ステージの移動と共に磁場が変動するという欠点があり、この欠点を補うために、ボールネジを非磁性体で

製作すると、負荷容量が小さくなるばかりか、高価になるという欠点がある。また、後者のような駆動機構の場合、外部に別のテーブル機構を有し、しかもベローズで真空シールを行なうために、それらの設置スペースを広く必要とするという欠点があった。

さらに、従来、特開昭56-36132号公報に開示されているように、ボールネジなどの駆動部を含めたステージ全体を磁気シールしてなる構成を有するものが提案されているが、この種構造では、磁気シール部分が広い範囲に亘り、しかも互いに相対移動する部材間に亘って閉磁性回路を形成する必要があることから、磁束の漏洩を完全に防止することが非常に困難であるという問題があった。

〔考案の目的〕

本考案は、上記の事情のもとになされたもので、ステージの移動と共に磁場の変動を起さず、設置スペースを広く必要としないステージ駆動装置を提供することを目的としたものである。

〔考案の概要〕

上記した目的を達成させるために、本考案は、試料が載置されるステージを真空チャンパ内で2次元方向に駆動させるステージ駆動装置において、前記2次元方向のうちの少なくとも一方向に移動すべくステージに添って真空チャンパ内に配置された移動体と、この移動体によってステージを前記一方向へ駆動すべく移動体とステージとを連結する連結板と、この連結板を通すスリットを有し前記移動体のみをその移動範囲全周に亘って囲繞する磁気シールドカバーとを具備する構成としたものである。

〔考案の実施例〕

以下、本考案を図示の一実施例を参照しながら説明する。

第1図及び第2図に示すように、図中1は真空チャンパである。この真空チャンパ1内には、上テーブル2、中テーブル3及び下テーブル4からなるステージが設置され、これら各々のテーブル2, 3, 4は非磁性体で形成されているとともに、前記上テーブル2上には、ホルダー5を介して試料となる基板Pが載置されるようになっている。前記上テーブル2は、ガイドレール6を介して中テーブル3に対しY方向に移動自在に支持されている一方、前記中テーブル3はガイドレール7を介して下テーブル4に対しX方向に移動自在に支持されているとともに、Y方向の駆動機構は、真空チャンパ1の外部に設けた他のステージ(図示せず)の駆動棒8を前記上テーブル2に接続させてなる構成を有し、かつ前記駆動棒8はベローズ9によって真空シールされている。そして、X方向の駆動機構は、真空チャン1内のステージの側面部に軸受10, 11を介して両端が軸支されたボールネジ12をX方向に沿って配置し、このボールネジ12に螺合させた磁性体の雌ネジ部材からなる移動体13に薄い連結板14を介して中テーブル3を連結するとともに、前記ボールネ

ジ12の正逆回転に伴う移動体13のX方向の往復直線運動によりステージをX方向に移動させてなるもので、前記ボールネジ12の回転駆動は、第1のカップリング15及び磁気シールユニット16を介して真空チャンパ1の外部に臨ませたボールネジ12の一方の軸端に第2のカップリング17を介して連結した駆動モータ18によって行なわれるようになっている。また、図中19は前記ボールネジ12に沿って移動する移動体13の移動範囲全周を囲繞するように配置した磁気シールドカバーで、前記連結板14の摺動範囲にはスリット20が設けられている。

すなわち、上記した構成によれば、磁性体で形成された移動体13の移動により磁場が変動するが、移動体13の移動範囲が磁気シールドカバー19でシールドされているため、磁場の変動は外部に影響されず、また、磁気シールドカバー19に設けたスリット20は、連続に形成されているものの、そのスリット間隙は薄い連結板14を通過可能にするだけで狭いために、スリット20からの磁束の漏洩を非常に少なくすることができるものである。

なお、上記実施例においては、ステージとボールネジとの連結を薄板で行なうことにより、ステージのガイド方向とボールネジの非平行部分で無理な力が掛からないようにしているが、ステージとボールネジの平行度を高くすれば、連結板の厚さを大きくして堅固に連結することができ、この場合でも磁気シールドカバーのスリットからの磁束の漏洩は少ない。また、磁気シールドカバーで囲まれた部分の真空排気性能を高めるために、磁気シールドカバーに小さな穴を明けても良い。

さらに、上記実施例では、真空チャンパ内での回転運動を直線運動に変換する機構としてボールネジを使用したのが、台形ネジやスキューローラ機構等の種々の変換機構、あるいはリニヤモータ機構等も使用することが可能である。

その他、本考案は、本考案の要旨を変えない範囲で種々変形実施可能なことは勿論である。

〔考案の効果〕

以上の説明から明らかなように、本考案によれば、移動体の移動による磁場の変動をより小形の磁気シールドで効果的に押さえることができると同時に、ステージ駆動装置の全体構成をコンパクトにできて設置スペースを狭くすることができるという効果が得られる。

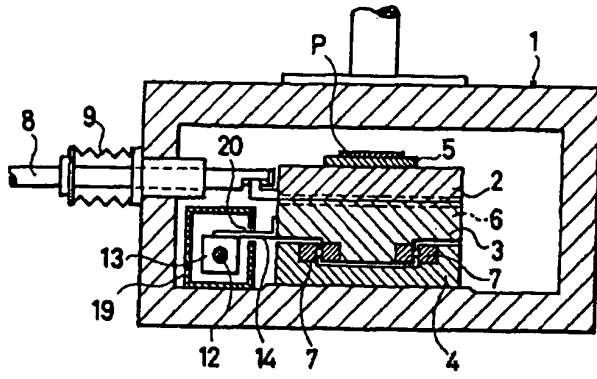
〔図面の簡単な説明〕

第1図は本考案に係るステージ駆動装置の一実施例を示す概略的縦断面図、第2図は同じく概略的横断面図である。

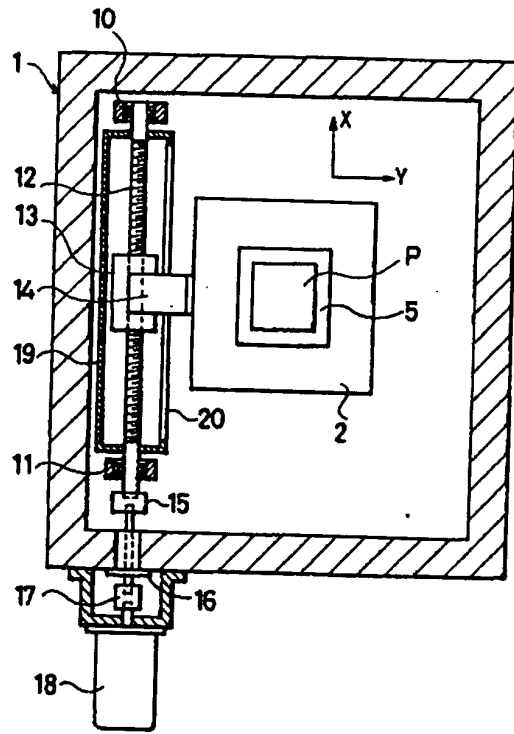
1……真空チャンパ、2……上テーブルステージ、3……中テーブルステージ、4……下テーブルステージ、12……ボールネジ、13……移動体、14……連結板、18……駆動モータ、19……磁気シールドカバー、P……試料(基板)。

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【第1図】



【第2図】



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**DETAILED DESCRIPTION**

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[Detailed explanation of a design]

[The technical field of a design]

This design is related with the stage driving gear in an electron beam exposure system etc.

[The technical background and its trouble] of a design

Many equipments can be considered as a drive system of the stage of an electron beam exposure system. For example, a ball screw is arranged in the vacuum chamber by which the substrate used as a sample is laid on a stage. The mechanism in which transmit driving force to a ball screw through a vacuum rotation seal from an external drive motor, and a stage is moved in the flat-surface two-dimensional direction of the direction of X, and the direction of Y, There is a mechanism in which establish another drive table mechanism out of a vacuum chamber, and the stage in a vacuum chamber and an external table are made to connect and drive with a drive rod through the bellows expanded and contracted etc.

However, if it is in equipment such conventionally, in order for there to be a fault of changing a magnetic field with movement of a stage since a ball screw is not usually nonmagnetic in the case of a drive like the former and to compensate this fault, when a ball screw is manufactured by non-magnetic material, there is load-carrying capacity's becoming small and a fault of becoming expensive. Moreover, in order in the case of a drive like the latter to have another table mechanism outside and for bellows to perform a vacuum seal moreover, there was a fault of needing those installation spaces widely.

furthermore, the member to which a magnetic seal portion covers the latus range and is moreover mutually displaced relatively with this seed structure although what has the composition which comes to carry out the magnetic seal of the whole stage including mechanical components, such as a ball screw, is proposed as conventionally indicated by JP,56-36132,A -- since it needed to continue in between and a closed magnetism circuit needed to form, there was a problem that where of it is very difficult to prevent disclosure of magnetic flux completely

[The purpose of a design]

This design was not made by the basis of the above-mentioned situation, and does not cause change of a magnetic field with movement of a stage, but aims at offering the stage driving gear which does not need an installation space widely.

[The outline of a design]

In order to make the above-mentioned purpose attain, this design In the stage driving gear which makes the stage in which a sample is laid drive in the two-dimensional direction within a vacuum chamber The mobile of the aforementioned two-dimensional directions which accompanied the stage that it should move to \*\* on the other hand at least, and has been arranged in a vacuum chamber, It has the connecting plate which connects a mobile and a stage that a stage should be driven in the one aforementioned direction by this mobile, and the slit which lets this connecting plate pass, and considers as the composition possessing magnetic-shielding covering which covers the moving range perimeter and surrounds only the aforementioned mobile.

[The example of a design]

Hereafter, it explains, referring to one example of illustration of this design.

As shown in a view 1 and the 2nd view, one in drawing is a vacuum chamber. in this vacuum chamber 1, the stage which consists of an upper inside table [ lower ] 2, 3, and 4 is installed, and while the tables 2, 3, and 4 of these each are formed by non-magnetic material, on the above top table 2, the substrate P which serves as a sample through an electrode holder 5 is laid While being supported free [ movement in the direction of Y ] to the inside table 3 through the guide rail 6 and the table 3 is supported free [ movement in the direction of X ] to the lower table 4 through the guide rail 7 during the above, the above top table 2 The drive of the direction of Y has the composition in which it makes it come to connect with the above top table 2 the drive rod 8 of other stages (not shown) established in the exterior of the vacuum chamber 1, and the vacuum seal of the aforementioned drive rod 8 is carried out with bellows 9. And the drive of the direction of X arranges the ball screw 12 with which ends were supported to revolve by the lateral portion of the stage in game 1 a vacuum through bearing 10 and 11 along the direction of X. While connecting the inside table 3 with the mobile 13 which consists of a female screw member of the magnetic substance made to screw in this ball screw 12 through the thin connecting plate 14 It is the thing which makes it come in the direction of X to move a stage by the both-way rectilinear motion of the direction of X of the mobile 13 accompanying the right inverse rotation of the aforementioned ball screw 12. the rotation drive of the aforementioned ball screw 12 It is performed by the drive motor 18 connected with one [ the exterior of the vacuum chamber 1 was made to face through the 1st distributor shaft coupling 15 and magnetic seal unit 16 ] axis end of the ball screw 12 through the 2nd distributor shaft coupling 17. Moreover, 19 in drawing is magnetic-shielding covering arranged so that the moving range perimeter of the mobile 13 which moves along with the aforementioned ball screw 12 may be surrounded, and the slit 20 is formed in the sliding range of the aforementioned connecting plate 14.

Namely, although a magnetic field is changed by movement of the mobile 13 formed with the magnetic substance according to the above-mentioned composition Since the moving range of a mobile 13 is shielded with the magnetic-shielding covering 19, the slit 20 which change of a magnetic field was not influenced outside and prepared in the magnetic-shielding covering 19 Although formed in continuation, since the slit gap is narrow only by enabling passage of the thin connecting plate 14, disclosure of the magnetic flux from a slit 20 can be lessened very much.

In addition, in the above-mentioned example, although it is made for the impossible force not to be applied by the non-parallel part of the guide direction of a stage, and a ball screw by performing connection on a stage and a ball screw with sheet metal, if parallelism of a stage and a ball screw is made high, thickness of a connecting plate can be enlarged, it can connect strongly, and there is little disclosure of the magnetic flux from the slit of magnetic-shielding covering also at this case. Moreover, in order to raise the evacuation performance of the portion surrounded with magnetic-shielding covering, you may break a small hole to magnetic-shielding covering.

Furthermore, although the ball screw was used as a mechanism in which rotation within a vacuum chamber is changed into rectilinear motion, in the above-mentioned example, various DBMS, such as a trapezoidal thread and a skew roller mechanism, and a certain thing [ using a linear motor mechanism etc. for being ] are possible.

In addition, this design of deformation implementation being variously possible in the range which does not change the summary of this design is natural.

[Effect of the Device]

While change of the magnetic field by movement of a mobile can be effectively pressed down by smaller magnetic shielding according to this design so that clearly from the above explanation, the effect that the whole stage driving gear composition can be made compact, and an installation space can be narrowed is acquired.

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[Translation done.]

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**TECHNICAL FIELD**

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[The technical field of a design]

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EFFECT OF THE INVENTION

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[Effect of the Device]

While change of the magnetic field by movement of a mobile can be effectively pressed down by smaller magnetic shielding according to this design so that clearly from the above explanation, the effect that the whole stage driving gear composition can be made compact, and an installation space can be narrowed is acquired.

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**TECHNICAL PROBLEM**

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[The technical background and its trouble] of a design

In the vacuum chamber in which the substrate which can consider many equipments as a drive system of the stage of an electron beam exposure system, for example, serves as a sample on a stage is laid, arrange a ball screw and mind a vacuum rotation seal from an external drive motor. There are a mechanism in which transmit driving force to a ball screw and a stage is moved in the flat-surface two-dimensional direction of the direction of X and the direction of Y, a mechanism in which establish another drive table mechanism out of a vacuum chamber, and the stage in a vacuum chamber and an external table are made to connect and drive with a drive rod through the bellows expanded and contracted, etc.

However, if it is in equipment such conventionally, in order for there to be a fault of changing a magnetic field with movement of a stage since a ball screw is not usually nonmagnetic in the case of a drive like the former and to compensate this fault, when a ball screw is manufactured by non-magnetic material, there is load-carrying capacity's becoming small and a fault of becoming expensive. Moreover, in order in the case of a drive like the latter to have another table mechanism outside and for bellows to perform a vacuum seal moreover, there was a fault of needing those installation spaces widely.

Furthermore, carry out the magnetic seal of the whole stage including mechanical components, such as a ball screw, so that it is conventionally indicated by JP,56-36132,A. the member which covers the range with a magnetic large seal portion with this seed structure, and is moreover mutually displaced relatively although what has the becoming composition is proposed -- since it needed to continue in between and the closed magnetism circuit needed to be formed, there was a problem that it was very difficult to prevent disclosure of magnetic flux completely

[The purpose of a design]

This design was not made by the basis of the above-mentioned situation, and does not cause change of a magnetic field with movement of a stage, but aims at offering the stage driving gear which does not need an installation space widely.

[The outline of a design]

In order to make the above-mentioned purpose attain. In the stage driving gear with which this design makes the stage in which a sample is laid drive in the two-dimensional direction within a vacuum chamber The mobile of the aforementioned two-dimensional directions which accompanied the stage that it should move to \*\* on the other hand at least, and has been arranged in a vacuum chamber, It has the connecting plate which connects a mobile and a stage that a stage should be driven in the one aforementioned direction by this mobile, and the slit which lets this connecting plate pass, and considers as the composition possessing magnetic-shielding covering which covers the moving range perimeter and surrounds only the aforementioned mobile.

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EXAMPLE

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[The example of a design]

Hereafter, it explains, referring to one example of illustration of this design.

As shown in a view 1 and the 2nd view, one in drawing is a vacuum chamber. in this vacuum chamber 1, the stage which consists of an upper inside table [ lower ] 2, 3, and 4 is installed, and while the tables 2, 3, and 4 of these each are formed by non-magnetic material, on the above top table 2, the substrate P which serves as a sample through an electrode holder 5 is laid While being supported free [ movement in the direction of Y ] to the inside table 3 through the guide rail 6 and the table 3 is supported free [ movement in the direction of X ] to the lower table 4 through the guide rail 7 during the above, the above top table 2 The drive of the direction of Y has the composition in which it makes it come to connect with the above top table 2 the drive rod 8 of other stages (not shown) established in the exterior of the vacuum chamber 1, and the vacuum seal of the aforementioned drive rod 8 is carried out with bellows 9. And the drive of the direction of X arranges the ball screw 12 with which ends were supported to revolve by the lateral portion of the stage in game 1 a vacuum through bearing 10 and 11 along the direction of X. While connecting the inside table 3 with the mobile 13 which consists of a female screw member of the magnetic substance made to screw in this ball screw 12 through the thin connecting plate 14 It is the thing which makes it come in the direction of X to move a stage by the both-way rectilinear motion of the direction of X of the mobile 13 accompanying the right inverse rotation of the aforementioned ball screw 12. the rotation drive of the aforementioned ball screw 12 It is performed by the drive motor 18 connected with one [ the exterior of the vacuum chamber 1 was made to face through the 1st distributor shaft coupling 15 and magnetic seal unit 16 ] axis end of the ball screw 12 through the 2nd distributor shaft coupling 17. Moreover, 19 in drawing is magnetic-shielding covering arranged so that the moving range perimeter of the mobile 13 which moves along with the aforementioned ball screw 12 may be surrounded, and the slit 20 is formed in the sliding range of the aforementioned connecting plate 14.

Namely, although a magnetic field is changed by movement of the mobile 13 formed with the magnetic substance according to the above-mentioned composition Since the moving range of a mobile 13 is shielded with the magnetic-shielding covering 19, the slit 20 which change of a magnetic field was not influenced outside and prepared in the magnetic-shielding covering 19 Although formed in continuation, since the slit gap is narrow only by enabling passage of the thin connecting plate 14, disclosure of the magnetic flux from a slit 20 can be lessened very much.

In addition, in the above-mentioned example, although it is made for the impossible force not to be applied by the non-parallel part of the guide direction of a stage, and a ball screw by performing connection on a stage and a ball screw with sheet metal, if parallelism of a stage and a ball screw is made high, thickness of a connecting plate can be enlarged, it can connect strongly, and there is little disclosure of the magnetic flux from the slit of magnetic-shielding covering also at this case. Moreover, in order to raise the evacuation performance of the portion surrounded with magnetic-shielding covering, you may break a small hole to magnetic-shielding covering.

Furthermore, although the ball screw was used as a mechanism in which rotation within a vacuum

chamber is changed into rectilinear motion, in the above-mentioned example, various DBMS, such as a trapezoidal thread and a skew roller mechanism, and a certain thing [ using a linear motor mechanism etc. for being ] are possible.

In addition, this design of deformation implementation being variously possible in the range which does not change the summary of this design is natural.

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**DESCRIPTION OF DRAWINGS**

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[Brief Description of the Drawings]

Similarly rough drawing of longitudinal section showing one example of the stage driving gear which a view 1 requires for this design, and a view 2 are rough cross-sectional views.

1 [ .. An inside table stage, 4 / .. A bottom table stage, 12 / .. A ball screw, 13 / .. A mobile, 14 / .. A connecting plate, 18 / .. A drive motor, 19 / .. Magnetic-shielding covering, P / .. Sample (substrate). ] ....  
A vacuum chamber, 2 .. A top table stage, 3

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[Translation done.]